TITLE OF THE INVENTION :

GEARSHIFT OPERATING DEVICE

BACKGROUND OF THE INVENTION:

<Field of the Invention>

The present invention relates to a gearshift operating device of an automatic manual transmission (hereinafter referred to as an AMT) for automatically performing a gearshift operation of a transmission having a synchro-mechanism or a dog-clutch and more particularly to speedup of the gearshift operation and realization of miniaturization and lightweight of the device.

<Prior Art>

Generally, a gearshift operating device performing the shift selection operation of a normally contact-mesh type transmission has a shift finger selectively joining to a plurality of shift fork shafts to join or dejoin a gear, an actuator for driving the shift finger in the si ft direction, a sensor for detecting a displacement of the shift direction, an actuator for driving the shift finger in the selection direction, and a sensor for detecting a displacement of the selection direction.

The actuators (for example, a motor) performing the operations in the shift direction and selection direction can be electrically controlled respectively and can independently perform the shift operation (joining and dejoining of the gear) and the selection operation (selection of the shift fork shafts) respectively.

On the other hand, in the normally contact-mesh type transmission,

the shift pattern called type H or double H is generally widespread and the shift finger draws a trace following the alphabetic character H to perform the shift and selection operations.

Namely, the shift finger operates in the direction parallel with the shift fork shaft to perform the shift operation (joining and dejoining of the gear) and in the neutral position, operates in the direction perpendicular to the shift operation to perform the selection operation , for example, refer to Patent Document 1 (Japanese Application Patent Laid-open Publication No. 2001-141047 (pages 4 and 5, Fig. 3)).

In the aforementioned gearshift operating device of the related art, the actuators performing the shift operation (joining and dejoining of the gear) and the selection operation are sequentially operated, so that the operation of switching the gear takes a lot of time.

Namely, when switching the gear, the motor for the shift operati on is driven first to dejoin the gear and when the gear is set in the neutral position, the motor for the selection operation is driven. When the shift finger is set in the position relating to the joining and dejoining part of a desired shift fork shaft, the motor for the shift operation is driven to push the shift fork shaft into the gear joining position.

In this operation, to perform the gear dejoining operation, the shift motor is accelerated and decelerated, and to perform the selection operation, the selection operation motor is accelerated and decelerated, and to perform the gear joining operation finally, the shift motor is accelerated.

In such a constitution of accelerating and decelerating the motor

three times in one gearshift operation like th is, the gearshift time can be hardly shortened and there is a possibility that the power consumption may be increased. The length of time required for the gearshift operation causes to an actual car a problem of uncomfortableness to ride in at the time of gearshift or blowup of the engine (an increase in fuel expenses).

Further, a conventional gearshift operating device is mostly large in shape and heavy in weight, so that it can be hardly loaded in a car having a small space around the transmission like a small-sized car.

SUMMARY OF THE INVENTION:

An object of the present invention is to provide a small -sized and lightweight gearshift operating device capable of quickly switching the gear at low power consumption.

To accomplish the above object, the present invention relates to a gearshift operating device of a contact -mesh type transmission for driving a shift selection shaft in the first direction and the second direction different from the first direction to perform the gear selection and gear joining and dejoining operations, which is structured so as to perform the gear selection and gear joining and dejoining operations by driving the shift selection shaft in the first direction and simultaneously driving the second actuator, thereby driving the shif t selection shaft in the first direction and simultaneously driving it in the second direction.

Further, the present invention relates to a gearshift operating device of a normally contact-mesh type transmission having a shift finger

selectively joining to or dejoining from the shift fork shafts of the normally contact-mesh type transmission, the shift selection shaft including the shift finger, at least one electrically controllable driving means for driving the shift selection shaft in the direction (the shift direction) parallel with the shift fork shafts, at least one electrically controllable driving means for driving the shift selection shaft in the direction (the selection direction) perpendicular to the shift fork shafts, a follower forming a part of the shift selection shaft, and a guide slit joined to the follower to guide the operation of the shift selection shaft, wherein the guide slit has a plurality of parallel parts parallel with the shift fork shafts and a plurality of slant parts connected so as to come to a point at the neutral position from the plurality of parallel parts.

Accordingly, the follower moves along the guide slit, thus the shift finger can move in the shift direction and simultaneously in the selection direction, and the number of times of starting and stopping the motor for performing the shift selection operation is reduced, and the time required for the gearshift operation is shortened. Further, the number of times of starting and stopping the shift operation motor is reduced , so that the power consumption is reduced.

Furthermore, when the follower moves obliquely along the slit, the driving force in the shift direction also acts partially in the selection direction, so that the burden imposed on the selection operation actuat or is lightened and the selection operation actuator can be miniaturized and lightened.

Or, in place of the actuator for driving the shift finger in the selection

direction, a simple actuator for applying only pressing force in the selection direction is provided. By doing this, in the same way as with the aforementioned, a high-speed gearshift operation can be performed, and the actuator for performing the gear selection operation at the neutral position is omitted, so that miniaturization of the device, lightweight, and low cost can be realized.

Or, in place of the actuator for driving in the selection direction, a gate mechanism capable of being electrically opened or closed is provided in the slit. By doing this, instead of giving pressing force in the selection operation direction for gear selection, the slit in which the follower can be moved is specified, thus the gear can be selected.

By doing this, in the same way as with the aforementioned, a high-speed gearshift operation can be performed, and the actuator for performing the gear selection operation at the neutral position is omitted, so that miniaturization of the device, lightweight, and low cost can be realized.

Furthermore, the clearance of the joint between the shift finger and the shift fork shafts is almost equal to or wider than the width of the shift finger. By doing this, in the gear dejoining operation, the concerned shift fork shaft can be moved almost to the neutral position and in the gear joining operation, interference of the unnecessary shift fork shafts can be avoided.

Furthermore, the follower width has some clearance for the width of the guide slit. By doing this, in the same way as with the aforementioned, in the gear dejoining operation, the concerned shift fork shaft can be

moved almost to the neutral position and in the gear joining operation, interference of the unnecessary shift fork shafts can be avoided.

BRIEF DESCRIPTION OF DRAWINGS:

Fig. 1 is a cross section view from the top showing an embodiment of the present invention;

Fig. 2 is a cross section view from the side showing an embodiment of the present invention;

Fig. 3 is a drawing showing the shape of a guide slit applied in an embodiment of the present invention;

Fig. 4 is a drawing showing a part of an operation object of the gearshift operating device of the present invention;

Fig. 5 is a drawing showing operations of the shift fork shafts operated by the gearshift operating device of the present invention;

Fig. 6 is a drawing showing a trace of the follower of the gearshift operating device of the present invention;

Fig. 7 is a cross sectional view showing the motion of the follower arm of the gearshift operating device of the present invention;

Fig. 8 is a cross section view from the top showing an embodiment of the present invention;

Fig. 9 is a cross section view from the side showing an embodiment of the present invention;

Fig. 10 is an illustration showing the pressing mechanism constituting an embodiment of the present invention;

Fig. 11 is an illustration showing the guide mechanism constituting

an embodiment of the present invention;

Fig. 12 is a drawing for explaining the operation of an embodiment of the present invention;

Fig. 13 is a drawing showing an example of the shape of the guide slit of the present invention; and

Fig. 14 is a cross section view from the side showing an embodiment of the present invention.

DESCRIPTION OF THE INVENTION

The embodiments of the present invention will be explained hereunder with reference to the accompanying drawings.

Figs. 1 and 2 show a constitution example of a gearshift operating device for performing the gearshift operation of a normally contact -mesh type transmission of 5 forward speeds and 1 backward speed, and Fig. 1 is a transverse cross sectional view thereof, and Fig. 2 is a longitudinal cross sectional view thereof.

A motor 10 for the shift operation installed in a housing 1 of the gearshift operating device amplifies the driving torque thereof by a planetary speed reducer 11, converts it to direct -acting power via a direct-acting conversion mechanism, for example, a rack 13 and a pinion 14, and acts force in the translation direction on a shift selection shaft 16 via a rotary coupling 15. The shift selection shaft 16 is attached to the housing 1 by bearings 24 for rotation and translation.

A motor 20 for the selection operation installed to the housing 1 of the gearshift operating device amplifies the driving torque thereof via a

planetary speed reducer 21 and acts rotary force on the shift selection shaft 16 via a gear 22 and a gear 23 operable axially. The shift selection shaft 16 is applied with action force in the translation direction by the motor 10 for the shift operation and applied with action force in the rotational direction by the motor 20 for the selection operation.

The shift selection shaft 16 is provided with a shift finger 30 to be selectively joined to or dejoined from the shift fork shafts of the transmission and the shift finger 30, in the same way as with the shift selection shaft 16, is applied with action force in the translation direction by the motor 10 for the selection operation and applied with action force in the rotational direction by the motor 20 for the selection operation.

Further, the housing 1 includes a displacement sensor 17 for measuring the displacement of the shift selection shaft 16 in the translation direction and a rotational angle sensor 18 for measuring the rotational angle of the shift selection shaft 16.

On the other hand, on the upper part of the shift selection sh aft 16, a follower arm 31 is provided integrally and passes through or is inserted into a guide slit 40 formed in a guide plate 2 provided on the top of the housing 1. In this case, the guide slit 40 is a slit formed in the guide plate 2 arranged on the top of the housing 1. In a part of the follower arm 31 in contact with the guide slit, a follower 33 is formed.

Fig. 3 shows a shape of the guide slit 40. The guide slit 40 has a plurality of parallel parts 41a to 41f and a plurality of slant parts 42a to 42d connected so as to come to a point from the plurality of parallel parts. Hereinafter, the point where the slant parts 42a to 42d are focused will be

referred to as a neutral point 43.

The plurality of parallel parts 41a to 41f are parallel with the s hift fork shafts. Hereinafter, this direction will be referred to as a shift direction. Further, the direction perpendicular to the shift direction shown in Fig. 3 will be referred to as a selection direction. In this case, even if the parallel parts 41 a to 41f are not strictly parallel with the shift fork shafts, it is not questionable functionally. The guide slit 40 guides the follower 33.

Therefore, the shift selection shaft 16 integral with the follower arm 31 and the shift finger 30 formed integral ly with the shift selection shaft 16 are also guided by the shape of the guide slit 40. In this case, the follower 33 is smoothly guided by the guide slit 40, so that it is desirable that the section thereof is circular or both ends thereof in the shift direction are faces having a small curvature.

Fig. 4 shows the relationship between the shift finger 30 and the shift fork shafts of the transmission. A general normally contact -mesh type transmission of 5 forward speeds and 1 backward speed has 3 shift fork shafts 51, 52, and 53. The respective shift fork shafts are operated axially, thus the gear is joined or dejoined.

For example, in a general normally contact -mesh type transmission of 5 forward speeds and 1 backward speed, the operation directions of the shift fork shafts and the joining gear are in the relation indicated by the thick arrows shown in Fig. 5.

The shift finger 30 selects any of projections 54, 55, 56, 57, 58, and 59 of the shift fork shafts to join, thereby axially operates any of the shi ft

fork shafts 51, 52, and 53 to join or dejoin the gear. For example, the shift finger 30 joins to the projection 59 of the shift fork shaft 53 and moves in the first speed direction shown in the drawing, thus the first speed gear is joined.

Further, thereafter, the shift finger 30 joins to the projection 58 of the shift fork shaft 53 and moves in the second speed direction shown in the drawing, thus the first speed gear is dejoined neutrally and then the second speed gear is joined. The follower arm 31 is on the opposite side of the shift finger 30 and the shift selection shaft 16, so that the follower arm 31 operates axially symmetrically to the shift finger 30.

Next, the operation and effects of this embodiment will be explained by referring to an example of the gearshift operation from the second gear to the third gear.

Figs. 5(a) to 5(e) are drawings showing the operations of the shift finger 30 and the shift fork shafts 51, 52, and 53 in time series when the transmission changes the speed from the second gear to the third gear. Further, Fig. 6 is a drawing showing the position of the follower 33 corresponding to the timing shown in Fig. 5 in the guide slit. Further, Figs. 7(a) to 7(e) are longitudinal cross sectional views of the gearshift operating device showing the inclination of the follower arm 31 corresponding Figs. 5 and 6.

When the gear of the transmission is joined to the second speed, the shift finger 30, as shown in Fig. 5(a), holds the shift fork shaft 53 in the joint position of the second speed gear. Since the follower 33 is axially symmetric to the shift finger 30, as shown in Fig. 6, it is in a

position 33a of the guide slit 40.

The dejoining operation for the second speed gear is performed by driving the motor for the shift operation , thereby applying driving force in the shift direction to the shift selection shaft 16. When the shift selection shaft 16 is applied with thrust in the shift direction, the shift finger 30 is also applied with thrust, joined to the projection 59 of the s hift fork shaft 53, and pushes the shift fork shaft 53 in the gear dejoining direction.

The shift fork shaft 53 is pushed by the shift finger 30 and as shown in Fig. 5(b), moved in the shift direction. At this time, the follower 33 moves on the parallel p art 41b of the guide slit 40 in the shift direction. The position in the state is indicated by 33b shown in Fig. 6.

When continuously applied with operation force in the shift direction, the follower 33 moves on the slant part 42b shown in Fig. 6. At thi s time, the follower 33 is guided by the slant part 42b of the guide slit 40, so that regardless of application of driving force in the selection direction, the follower 33 moves along the slant part 42b.

When the follower 33 moves obliquely, the follower arm 31 and the shift selection shaft 16 rotate and move side by side in the shift direction. Simultaneously, the shift finger 30 moves obliquely in the opposite direction of the follower 33 and pushes the shift fork shaft 53 in the shift direction by movi ng side by side in the selection direction.

The shift finger 30 moves side by side in the direction of separation from the shift fork shaft 53, so that as shown in Fig. 5(c), the joint with the projection 59 of the shift fork shaft 53 comes off in a certai n position. At this time, the second speed gear is dejoined already and the shift fork

shaft 53 is almost in the neutral position.

The position of the follower 33 in this state is indicated by 33c shown in Fig. 6 and the longitudinal cross sectional view of the gearshift operating device showing the inclination state of the follower arm 31 is shown in Fig. 7(c).

Further, when the gap amount between the projection of the shift fork shaft and the shift finger 30 and the trace of the slant part of the guide slit 40 are properly set, the shift fork shaft 53 can be dejoined from the shift finger 30 in the neutral position.

Even if the shift fork shaft 53 is dejoined from the shift finger 30 in a position different from the correct neutral position, the shift for k shaft 53, as long as no pressing force is acted on it from the shift finger 30, is not joined to the first speed gear or second speed gear and is set almost in the neutral position by the positioning mechanism arranged in the transmission.

Next, when the follower, as indicated by 33d in Fig. 6, passes through the slant part 42b and approaches the neutral point 43, the motor 20 for the selection operation is operated to control the follower 33 to be arranged on the line of the parallel part 41e in the shif t direction.

At this time, the shift finger 30, as shown in Fig. 5(d), is on the shift fork shaft 52 and when it goes straight on in the shift direction as it is, it joins to the projection 57, thereby can push the shift fork shaft 52. Further, the positi on of the follower arm is as shown in Fig. 7(d).

Finally, when the follower 33 in the aforementioned position operates the motor for the shift operation to drive the shift selection shaft

16 in the shift direction, the follower 33 enters the parallel part 41e and strokes along the central slit 41e up to the position indicated by 33e in Fig. 6. At this time, the shift finger 30, as shown in Fig. 5(e), joins to the projection 57 of the shift fork shaft 52 and pushes the shift fork shaft 52 up to the joint position of the third speed gear.

By the aforementioned operation, the gearshift operation from the second gear to the third gear is performed.

Next, the gearshift operation from the second gear to the first gear or the fifth gear will be explained. Before dejoining the second speed gear, the aforementioned procedure is performed.

When the follower 33 passes through the slant part 42b shown in Fig. 6 and reaches the position 33d (in the neighborhood of the neutral point 43), the follower 33 operates the moto r 20 for the selection operation to move to the entrance of the slant part 42c (when changing to the first speed) shown in Fig. 3 or the slant part 42a (when changing to the fifth speed).

When the follower 33 passes through the slant part 41c or 41a and moves to the parallel part 41c or 41a, the shift fork shaft 53 or 51 is shifted and the first speed or fifth speed gear is joined. At this time, the follower 33 is guided by the slant part 41c or 41a, so that only by operation force in the shift direction, the follower 33 can move obliquely.

The reason is that the force required for the shift operation is generally larger than the force required for the selection operation, so that the selection operation can also be performed by the motor for the shift operation.

In this series of operation, the motor 10 for the shift operation can complete the gearshift operation without stopping halfway. Therefore, the gearshift time is shortened and the energy required for acceleration and deceleration of the motor can b e reduced.

Further, when changing the speed from the second gear to the fourth gear or the reverse step, before completion of the dejoining operation for the second speed gear, the aforementioned procedure is performed.

Namely, when the follower 33 reaches the position 33d shown in Fig. 6, the motor 20 for the selection operation is operated to move the follower 33 to the entrance of the parallel part 41f (when changing to the fourth speed) or the slant part 42b (when changing to the reverse speed).

Thereafter, when the motor 10 for the shift operation is rotated reversely, the follower 33 passes through the parallel part 41f or 41b, moves on the parallel part 41f or 41b, operates the shift fork shaft 52 or 51, and joins the fourth speed gear or reverse -speed gear.

When changing the speed from the other gears, the gearshift operation from the second gear is similarly performed. Namely, the motor 10 for the shift operation is operated first to generate driving force in the shift direction and the follower 33 is guided along the guide slit 40 and moved to the neutral point 43. At this time, the shift finger 30 joins to the projection of any of the shift fork shafts and operates the concerned shift fork shaft until the gear is dejoined.

Next, the motor 20 for the selection operation is operated in the neighborhood of the neutral point 43 to move the follower 33 to the

entrance of a desired guide slit. Finally, the motor 10 for the shift operation is driven to guide and shift the follower 33 in the guide slit an d to join a desired gear.

When looking back at the aforementioned operation, regarding the gear dejoining operation, the follower 33 is guided obliquely or linearly by the guide slit 40, so that when operation force is just applied in the shift direction, even if no or small operation force is applied in the selection direction, the follower 33 can be moved to the neutral point 43.

The force required for the selection operation is generally smaller than the force required for the shift operation, so that t he motor for the shift operation can be used for the selection operation.

Further, regarding gear selection, the follower 33 is operated only at a minute distance in the selection direction from the state at the neutral point and moved to the entrance of a ny of the neighboring slits.

Further, after selection positioning, when the follower 33 enters the slant part by the shift operation, the follower 33 is guided obliquely by the guide slit 40, so that only by the operation force in the shift direction, the follower 33 can be operated in the selection direction.

Therefore, in gear dejoint and gear joint, the operation force in the selection direction is not necessary and the moving distance in the selection operation is very small, so that the actuator for th e selection operation has force weaker than that of the actuator for the selection operation of a conventional gearshift operating device, thus a narrow use range can be applied.

Further, when the follower 33 passes through the slant part and

performs the gear dejoining operation, the follower 33 moves in the shift direction along the guide slit and simultaneously moves in the selection direction, so that the conventional operation of dejoining the gear first, stopping in the neutral position, and performin g the selection operation next is not required.

Similarly in the gear joining operation, when the follower passes through any of the slant parts from the neutral point and moves to the parallel part, the follower 33 moves in the selection direction along t he guide slit and simultaneously moves in the shift direction, so that the conventional operation of finishing the selection operation and then starting the actuator for the shift operation is not required.

Therefore, in the gearshift operating device wit h a guide slit formed of the present invention, every time of gear dejoint, gear selection, and gear joint, the actuator for the shift or selection operation is not required to start or stop and the gearshift operation is performed in the state of continuously driving the actuator for the shift operation, so that the gearshift operation time as a whole can be shortened greatly.

Further, the number of times of starting and stopping the motor 10 for the shift operation is reduced, so that the power consumpti on can be controlled.

For example, there is a case that, like gearshift from the first speed gear to the third speed gear, the operation direction of the actuator for the shift operation is reversed once at the neutral point 43, so that the operation is stopped. Nevertheless, the number of times of start and stop is smaller than that of the gearshift operation according to the

conventional double H pattern by one time and the operation time is short.

As described in the aforementioned embodiment, according to the present invention, the gearshift operating device is provided with a guide slit having a slant part, so that only by the driving force in the shift direction, the shift finger 30 can be driven in the selection direction. Therefore, the actuator for the selection operation just performs a minute positioning operation at the neutral point, thereby can select the gear.

Next, an embodiment in which as an actuator to be given pressing force using that the stroke of an actuator necessary for the selectio n operation is short, a solenoid is used is shown in Fig. 8.

Fig. 9 is a drawing when Fig. 8 is viewed from the top. At the time of gear selection, when the follower 33 is pressed toward a desired slit to give operation force in the shift direction, the follower 33 can be moved to the desired slit. Actuators 25 and 26 give pressing force to the follower arm 31 in the neighborhood of the neutral point 43.

The actuators 25 and 26, for example, as shown in Fig. 10, has a mechanism that a link mechanism 28 i s installed in a pull -type solenoid 27. When the pull-type solenoid 27 is supplied a current, a pressing face 29 is pushed out to apply pressing force to the follower arm. The follower arm is applied with pressing force only in the neighborhood of the neutral point 43, so that the stroke of the actuators 25 and 26 may be short.

Further, to prevent the pressing face 29 from disturbing the follower arm when the follower is returned from the gear joint position to the neutral point 43, it is effective to fo rm slopes 29a and 29b on the pressing

face 29.

By use of the mechanism using a solenoid, the motor for the selection operation can be abolished, and the gearshift operating device can be miniaturized and lightened, and the cost can be decreased. Further, the solenoid is highly responsive, so that the gear can be selected at high speed at the neutral point 43.

The aforementioned embodiment indicates the structure using a planetary speed reducer for the speed reducer and a rack pinion for the motion conversion mechanism. However, the gearshift operating device of the present invention may be formed by using machine elements having the equal speed reduction or motion conversion function such as a worm gear or a spur gear for the speed reducer and a ball screw for the motion conversion mechanism.

Further, the aforementioned embodiment indicates an example that the guide slit 40 is formed on the top of the gearshift operating device. However, the guide slit may be arranged on the bottom of the gearshift operating device. The longitudinal cross sectional view of a configuration example thereof is shown in Fig. 14. The basic constituent parts are the same as those shown in Fig. 2.

The guide plate 2 forming the guide slit 40 and the follower 33 guided by the guide slit 40 are arranged on the bottom of the shift selection shaft 16. In this case, the guide slit 40 is arranged in the same direction as that of the shift finger 30 and the shift selection shaft 16, so that the trace of the shift finger 30 and the trace of the follower 33 are similar to each other. The slit shape when the guide slit 40 is arranged

on the bottom is line-symmetric to that when it is arranged on the top.

Next, as another means for gear selection at the neutral point 43, a rotatory plate having a slit is shown in Fig. 11. This mechanism is arranged on the top or bottom of the guide plate 2. For reference, the corresponding guide slit 40 is indicated by a dotted line.

A rotary plate 51 is installed for rotation on the housing 1, for example, by support portions 53a to 53d and rotated by an actuator 54 for the rotation operation. A slit 52 of the rotary plate 51 is a linear slit, for example, having a width through which the follower can pass at the center and both ends thereof are swollen. The rotary plate 51 limits the movable range of the follower arm together with the guide slit 40 to guide the follower 33.

When the follower 33 is located at the neutral point 43, the actuator 54 for the rotation operation rotates the rotary plate 51 to d ecide the direction of the slit 52. When the rotary plate 51 is rotated so that the follower 33 moves toward a desired guide slit, the gear to be selected can be optionally decided.

Also in this embodiment, the load required for the rotation operation is lighter than the load required for the conventional selection operation, so that the actuator required for the conventional selection operation can be miniaturized and lightened and the whole gearshift operating device can be miniaturized and lightened.

As another method different from the aforementioned for optionally selecting the gear from the neutral point, there is a method of arranging an electrically controllable gate at each junction of the guide slit. For

operation explanation, as shown in Fig. 12, an example of a guide slit having four branch slits is used. Electrically controllable gates 35a to 35d are arranged at the entrances branching to the respective slits from the neutral point 43 on the guide slit 40.

Each gate is opened by power supply and closed by stopping power supply. For example, when leading the follower 33 from the neutral point 43 to the slant part 42b, only the gate 35a arranged at the entrance of the slant part 42b is opened and the other gates 35b to 35d are closed.

And, when driving force in the shift direction is given to the follower 33, the follower 33 is guided by the slant part of the closed gate 35b, passes through the opened gate, and moves to the slant part 42b. The subsequent gear joining operation is the same as that of the aforementioned embodiments.

In the embodiments shown in Figs. 1 to 11, as a shift pattern of a general normally contact-mesh type transmission of 5 forward speeds and 1 backward speed, an example of a shift pattern in a shape as shown in Fig. 13(a) is indicated. However, with respect to the shift pattern of an actual transmission of 5 forward speeds and 1 backward speed, as shown in Fig. 13(b), there exists a shift pattern having a reverse position relationship of 5 speeds and reverse speed.

Also in such a case, the basic operation method is the same as that of the aforementioned embodiments and the present invention can be applied. Further, when the present invention is to be applied to a normally contact-mesh type transmission of 4 forward speeds and 1 backward speed, the shift patterns shown in Figs. 13(c) to 13(e) may be

used.

Regardless of the arrangement position of the backward gear, when the shape of the guide slit is decided so as to move the shift finger to the position, the gearshift ope rating device of the present invention can be realized. In all cases, the device has slant slits comprising slits parallel with the shift fork shafts as many as the number of gears for bringing them to the neutral point.

Further, with respect to the oper ation, in all cases, the follower commonly goes obliquely or straight on toward the neutral point and the follower 33 is commonly operated minutely in the selection direction at the neutral point to select the gear. Further, in the shift pattern of some FF car, the shift and selection directions are different from those of the shift pattern of a regular FR car.

However, also in such a pattern, for example, by use of the shape shown in Fig. 13(f), the gearshift operating device of the present invention can be realized. Further, as indicated in the embodiment shown in Fig. 14, when the guide slit is positioned between the shift selection shaft 16 and the shift finger 30, a slit in a shape line -symmetric to each of the shift patterns shown in Figs. 13(a) to 1 3(f) is applied.

Meanwhile, between the projections 54 to 59 and the shift finger 30 shown in Fig. 4, some gap must be provided. While the gap is moved in the shift direction, the shift finger moves in the selection direction, so that to realize the prese nt invention, a gap of some size must be formed.

When the gap is too large, the hysteresis of the shift fork shaft is increased, while when it is too small, the follower cannot be guided

smoothly. The previous study shows that the size of the gap between the projections and the shift finger is preferably equal to or wider than the width of the shift finger.

Furthermore, the guide slit shown in Fig. 3 has linear slant parts. However, to smoothly move the follower in the shift direction and simultaneously guide it in the selection direction, the slant parts preferably have a bent shape. Further, the slant parts and parallel parts are preferably connected smoothly to each other.

Furthermore, to make the friction resistance between the follower 33 and the guide slit smaller, the follower is preferably provided with a roller.

Furthermore, as shown in Fig. 5, the shift finger 30 moves obliquely to enter between the projections 54 to 59, so that the corners of the shift finger 30 are preferably rounded so as to easily enter between the projections.

Furthermore, the follower preferably has clearance for the guide slit so as to generate good hysteresis in the trace of the shift finger 30.

The embodiments indicate the device for operating the transmission of a car. However, the device may be applied similarly to gearshift test equipment and gearshift feeling evaluation equipment.

Further, as actuators for the operations in the shift direction and selection direction, even if not only motors such as a DC motor, a DC brushless motor, and an AC motor but also a hydraulic actuator and an air pressure actuator are used, the same effects can be obtained.

As explained above, according to the present invention, a guide slit having a plurality of slits parallel with the shift fork shafts and a plurality of

slant slits concentrated to the neutral point from them is provided, and the follower is operated in accordance with the guide slit, thus the shift finger can perform the selection operation and simultaneously the gear dejoining or gear joining operation, so that the time required for the gearshift operation can be shortened and the power consumption can be reduced.

In addition to it, the actuator for the selection operation can be made compact and miniaturization and lightwe ight of the whole device can be realized. In an actual car, a gearshift operating device having a good loading property for performing a quick gearshift operation and actualizing comfortableness to ride in can be realized.

Further, the actuator for the se lection operation can be omitted or miniaturized, so that the cost of the gearshift operating device can be reduced.

According to the present invention, the gearshift operation can be performed in a short time and the gearshift operating device can be miniaturized and lightened.